insulation film 202, and this state is held at about one minute. In this manner, a second heating process is applied to the vanish.

According to experiments made by the Inventor et al, as in the step 2 and step 3, a heating method for increasing the vanish temperature in a stepwise manner is employed, thereby clearly making it possible to evaporate a component (for example, solvent) other than polymethyl siloxane that is one of the essential components of the polymethyl siloxane film in the vanish and to effectively fix the coat film.

Step 4:

While the semiconductor substrate 201 is placed on the hot plate 204, the substrate is disposed under a reduced pressure atmosphere in which a pressure is reduced to about 0.1 Torr so as to prevent oxidization of a vanish and the polymethyl siloxane film formed based on the vanish. At this time, the atmosphere in which the semiconductor substrate 201 is disposed is filled with a gas essentially consisting of nitrogen (N_2) gas.

In this state, the temperature of the hot plate 204 is controlled so that the vanish temperature is held at about 400℃, and a vanish is heated together with the semiconductor substrate 201. In addition, as indicated by the arrow shown in FIG. 9B, the electron beam is irradiated from an electron beam irradiation

device (not shown) to the vanish under a condition of about 6 KeV in irradiation energy and about 5000 $\mu C/cm^2$ in total irradiation quantity. The total irradiation quantity is not limited to the above value, i.e. the total irradiation quantity is set that the modified layer 204b can be formed. In this manner, a polymethyl siloxane film that is a second interlayer insulation film 204 is formed on a first interlayer insulation film 202.

As has been described above, in the present embodiment, while a heating process is applied to a vanish only in the step 4 that is a final step of the steps 2 to 4, and the vanish is irradiated with the electron beam.

The reason is to prevent from forming an interlayer insulation film with its low dielectric rate having undesirable characteristics caused by a modification of components other than polymethyl siloxane such as solvent contained in a vanish. The modification occurs by irradiating the vanish that is not fixed on the silicon nitride film 105 with the electron beam.

That is, this is because a polymethyl siloxane film is obtained as an interlayer insulation film 106 with its low dielectric rate having desired characteristics.

The second interlayer insulation film (polymethyl

siloxane film) 204 formed through the steps 1 to 4 described above is formed while the film is separated into three layers 204a, 204b, and 204a in which the internal characteristics change along its film thickness direction, as shown in FIG. 9B.

In more detail, when a heating process is applied to a vanish in the step 4, the electron beam is irradiated together with the heating process, the characteristic of the polymethyl siloxane film has a distribution of absorption of energy shown as in FIG. 10.

That is, a majority of electron beam energy is absorbed at an intermediate part in the film thickness direction of the polymethyl siloxane film.

Despite the raw material for the polymethyl siloxane film is obtained as a vanish consisting of its single property, the intermediate part in the film thickness direction of the polymethyl siloxane film by which almost of the electron beam energy is absorbed is formed to be modified so as to have properties that differ from both ends in the film thickness direction in which almost no electron beam energy is absorbed.

Specifically, a modified layer (modified portion) 204b being an intermediate portion (intermediate layer) in the film thickness direction of the polymethyl siloxane film modified by the electron beams, is formed so that an etching rate is smaller than that of a